**Claims:**

1. A controller for a SMA actuator, the SMA actuator including at least one SMA element, the controller including:

an electrical power source for applying an electrical current through the SMA element;

a sensor to detect change in an electrical resistance of the SMA element; and

a regulator for controlling a magnitude of the applied electrical current, said regulator applying a first current above a safe limit current for the SMA element until a selected change in said electrical resistance is detected and applying a second current less than said first current after said change is detected.

2. A controller as claimed in claim 1, wherein said selected change corresponds to a range of temperatures for the SMA element at and below which thermal damage of the SMA element will not occur.

3. A controller as claimed in claim 1 or claim 2, wherein the selected change includes a safety factor or margin.

4. A controller as claimed in claim 3, wherein the safety factor or margin allows for strain induced variation in the resistance of the SMA element.

5. A controller as claimed in any one of claims 1 to 4, wherein the controller progressively reduces the first current applied through the SMA element as a function of the detected electrical resistance.

6. A controller as claimed in claim 5, wherein the controller substantially smoothly reduces the first current applied through the SMA element as a function of the detected electrical resistance.

7. A controller as claimed in claim 5 or claim 6, wherein the reduction of the first current occurs over a range of electrical resistances within, but adjacent to the boundary of, the selected change.

8. A controller as claimed in any one of claims 1 to 7, wherein the current applied through the SMA element is a substantially steady DC current.

9. A controller as claimed in any one of claims 1 to 7, wherein the current applied through the SMA element is an intermittent DC current.

10. A controller as claimed in any one of claims 1 to 7, wherein the current applied through the SMA element is an AC current.

11. A controller as claimed in any one of claims 1 to 10, wherein the change in the electrical resistance of the SMA element is detected by measuring the electrical resistance of the SMA element.

12. A controller as claimed in any one of claims 1 to 10, wherein the change in the electrical resistance of the SMA element is detected by measuring the electrical impedance or other characteristic indicative of the electrical resistance of the SMA element.

13. A controller as claimed in any one of claims 1 to 12, wherein the electrical resistance of the SMA element is detected substantially continuously.

14. A controller as claimed in any one of claims 1 to 12, wherein the electrical resistance of the SMA element is detected substantially at selected intervals.

15. A controller as claimed in any one of claims 1 to 14, wherein the SMA element is a substantially straight wire.

16. A controller as claimed in any one of claims 1 to 14, wherein the SMA element is a substantially helically wound wire.

17. A controller as claimed in claim 15 or claim 16, wherein the SMA actuator includes two or more SMA elements working in parallel.

18. A controller as claimed in any one of claims 1 to 17, wherein the controller has an initialisation or calibration mode in addition to a normal operating mode, the initialisation or calibration mode measuring and recording the hot and/or cold electrical resistances of the SMA element.

19. A controller as claimed in claim 18, wherein the controller enters the initialisation or calibration mode automatically upon the SMA actuator being powered up.

20. A controller as claimed in claim 19, wherein the controller enters the initialisation or calibration mode automatically upon command.

21. A controller as claimed in claim 19 or claim 20, wherein the initialisation or calibration operation includes applying at least one test current through the SMA element, measuring the electrical resistance to the test current, and determining the selected change from the measured resistance.

22. A controller as claimed in any one of claims 1 to 21, including a motion control system for computing the desired degree of actuation of the actuator as a function of the discrepancy between a desired motion or position of an output element of the SMA actuator and a detected actual motion or position of the output element.

23. A controller as claimed in any one of claims 1 to 22, wherein a gain of the motion control system is set high so that a small position error will result in a correctional signal that exceeds the safe limit current of the SMA element.

24. A controller as claimed in any one of claims 1 to 23, wherein the current regulator is able to apply a third current to maintain the SMA element in an austenite phase, the third current being significantly less than the safe limit current.

25. A controller as claimed in any one of claims 1 to 24, wherein, if the measured resistance of the SMA element exceeds a selected upper operating limit or falls below a selected lower operating limit, the controller issues a malfunction or error signal indicating that the actuator is not functioning correctly.

26. A SMA actuator including:

at least a first SMA element;

an output element operably associated with the SMA element, the output element moving in response to the actuation of the SMA element; and

a controller as claimed in 1 to 25 for controlling the actuation of the SMA element.

27. A SMA actuator as claimed in claim 26, including a second SMA element, said SMA elements being operably arranged so that the contraction of one of the SMA elements complementarily exerts a stretching force on the other of the SMA elements.

28. A method of heating at least one SMA element of an SMA actuator, the method including:

applying an electrical current through the SMA element; and

detecting change in the electrical resistance of the SMA element;

wherein

a first current above a safe limit current for the SMA element is applied until a selected change in said electrical resistance is detected and a second current less than said first current is applied after said change is detected.

29. A method as claimed in claim 28, wherein said selected change corresponds to a range of temperatures for the SMA element at and below which thermal damage of the SMA element will not occur.

30. A method as claimed in claim 28 or claim 29, wherein the selected change includes a safety factor or margin.

31. A method as claimed in claim 30, wherein the safety factor or margin allows for strain induced variation in the resistance of the SMA element.

32. A method as claimed in any one of claims 28 to 31, including progressively reducing the first current applied through the SMA element as a function of the detected electrical resistance.

33. A method as claimed in claim 32, including substantially smoothly reducing the first current applied through the SMA element as a function of the detected electrical resistance.

34. A method as claimed in claim 32 or claim 33, wherein the reduction of the first current occurs over a range of electrical resistances within, but adjacent to the boundary of, the selected change.

35. A method as claimed in any one of claims 28 to 34, wherein the current applied through the SMA element is a substantially steady DC current.

36. A method as claimed in any one of claims 28 to 34, wherein the current applied through the SMA element is an intermittent DC current.

37. A method as claimed in any one of claims 28 to 34, wherein the current applied through the SMA element is an AC current.

38. A method as claimed in any one of claims 28 to 37, including detecting the change in the electrical resistance of the SMA element by measuring the electrical resistance of the SMA element.

39. A method as claimed in any one of claims 28 to 37, including detecting the change in the electrical resistance of the SMA element by measuring the electrical impedance or other characteristic indicative of the electrical resistance of the SMA element.

40. A method as claimed in any one of claims 28 to 39, including detecting the electrical resistance of the SMA element substantially continuously.

41. A method as claimed in any one of claims 28 to 39, including detecting the electrical resistance of the SMA element substantially at selected intervals.

42. A method as claimed in any one of claims 28 to 41, wherein the SMA element is a substantially straight wire.

43. A method as claimed in any one of claims 28 to 41, wherein the SMA element is a substantially helically wound wire.

44. A method as claimed in claim 42 or claim 43, wherein the SMA actuator includes two or more SMA elements working in parallel.

45. A method as claimed in any one of claims 28 to 44, including measuring and recording the hot and/or cold electrical resistances of the SMA element as part of an initialisation or calibration operation.

46. A method as claimed in claim 45, wherein the initialisation or calibration operation is performed automatically upon the SMA actuator being powered up.

47. A method as claimed in claim 45, wherein the initialisation or calibration operation is performed automatically upon command.

48. A method as claimed in any one of claims 45 to 47, including as part of the initialisation or calibration operation applying at least one test current through the SMA

element, measuring the electrical resistance to the test current, and determining the selected change from the measured resistance.

49. A method as claimed in any one of claims 28 to 48, including computing the desired degree of actuation of the actuator as a function of the discrepancy between a desired motion or position of an output element of the SMA actuator and a detected actual motion or position of the output element.

50. A method as claimed in any one of claims 28 to 49, including applying a third current to maintain the SMA element in an austenite phase, the third current being significantly less than the safe limit current.

A method as claimed in any one of claims 28 to 50, including, if the measured resistance of the SMA element exceeds a selected upper operating limit or falls below a selected lower operating limit, issuing a malfunction or error signal indicating that the actuator is not functioning correctly.